# "Burnout" in Dance
## The Physiological Viewpoint

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The ever-increasing demands for more and better performances have forced preparation for successful dance to become virtually a year-round endeavor. However, while better stage performances have indeed been achieved world-wide, an increased number of dancers also experience feelings of constant fatigue, frequent respiratory tract infections, and frequent injuries. These symptoms can inevitably affect an individual's ability to perform, while at the same time constitute part of the recently described "burnout" or "overtraining."

The exact point where increased levels of exercise and training cause burnout or overtraining is difficult to define. Nevertheless, it is known that disproportional increases in either frequency or intensity of physical work, in conjunction with insufficient recovery, may overload the mechanisms of adaptation creating havoc in the muscle tissue, upsetting the body's immunity, and harassing the delicate balance of the hormonal system.

### Definition of Terms

The terms *burnout* (or *overtraining,* or *overtraining syndrome*, or *overwork, staleness*), *chronic fatigue* (or *chronic fatigue syndrome*) and *post-viral fatigue* are generally and interchangeably used to describe the condition where active individuals:

- Complain of reduced physical performances for no apparent medical or other obvious reasons[1,2];
- Suffer from constant and prolonged fatigue[3,4]; and
- Show an array of behavioral and emotional changes.[5]

Although the causes of the classical chronic fatigue are still unclear, the main triggering element of burnout is not. In this case, fatigue and the consequent under-performance in physical tasks are somehow linked to increased volumes of exercise training. Unlike classical chronic fatigue, burnout is a relatively new entry in the medical vocabulary, with the confirmed cases spreading worldwide in line with the popularity of sport and dance. Post-viral fatigue is also characterized by constant and prolonged fatigue and has an identifiable source: inadequate recovery from a virus infection before the return to demanding training and exercise schedules.

### Factors Contributing to Burnout

Burnout is a clinically complex condition of indeterminate cause with a range of symptoms and signs varying from person to person. It tends to occur in dancers during periods of increased commitments either in class or on stage and in individuals whose daily practices produce an imbalance between physical activity and *recovery* from it. However, optimal recovery should always be part of programs designed to improve fitness and physical performance.[6]

Following intense dance, the variety of micro-damage to body structures (mainly in muscle) needs to be repaired in order to prevent further damage in subsequent workouts. At the same time, muscle must adapt. For example, more proteins must be laid down to enable muscles to produce greater forces, more enzymes – involved in energy production – must be synthesized, and more oxygen has to be supplied to the energy production sites via a sufficiently developed capillary network. However, for the muscle to succeed in all these task, an appropriate length of time is required with little or no physical activity. This repair-adaptation process seems to peak 12 to 24 hours after exercise, when muscle protein synthesis reaches its highest rates.[7]

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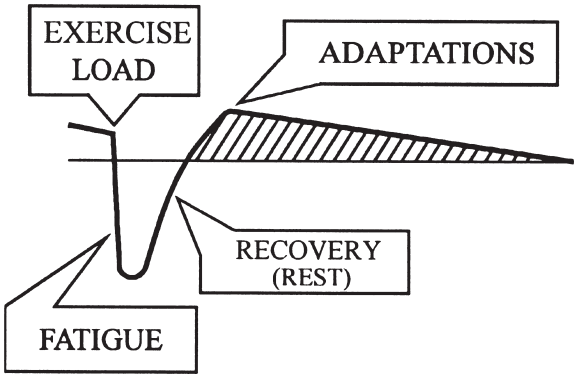


**Figure 1** Following recovery, the tissues are adapted to tolerate higher exercise load, i.e., the dancer is in a higher state of fitness. (Reproduced with permission from: Koutedakis Y, Sharp NCC: The Fit and Healthy Dancer. John Wiley & Sons, Chichester, UK, 1999.)

Figure 1 shows the relationship between exercise load and recovery during which positive adaptations occur in key performance parameters such as strength, power, and endurance. Inadequate recovery may negatively affect the mechanism of adaptation and, therefore, levels of fitness and/or health. In fact, Steinacker[8] has cautioned that if high volumes of exercise and training are undertaken (more than 1,000 hours per year) even work at moderate levels may be felt as an intensive effort.

The dancers most prone to reach the stage of burnout are the highly motivated, the overachievers, and those who set high standards for themselves. In these individuals, the feeling of guilt quickly emerges if a day or two goes by without dance workouts, as it is wrongly believed that lack of daily practice may negatively affect dance capabilities. Indeed, at least one publish report has indicated that 3 to 5 weeks of rest after the end of a dance season may actually lead to increases in most dance-related fitness parameters.[9] In this same report it was concluded that fatigue and perhaps burnout at the end of the dance season were partly responsible for the findings.

Relatively low levels of physical fitness may also contribute to the development of burnout. For the same workload, those that are less physically fit are working harder than their physically fit couterparts,[10] thus logically they are more prone to experience burnout. External stresses such as family and personal relationships, media attention, conditions at work, and financial difficulties may further contribute to the development of this condition. And interestingly, "individual" activities (e.g., cycling, swimming, and dance) are likely to produce more cases of burnout than team-events such as basketball and volleyball.[11]

## Symptoms

When feelings of constant fatigue and poor class and stage performance are simultaneously present, other symptoms have to be considered. These are non-specific and may vary from dancer to dancer. Symptomatology may include[12]:

- Excessive sweating,
- Inability to recover optimally following intensive dancing,
- Loss of desire and enthusiasm for dance (feelings of helplessness),
- Breakdown of technique,
- Poor concentration,
- Loss of appetite and loss of body weight,
- Disturbed sleep often with nightmares or vivid dreams,
- Increased incidents of nocturnal enuresis,
- Increased susceptibility to injuries,
- Increased anxiety and irritability, and
- Signs of depression.

## Signs

As in the case of symptoms, there are no consistent signs on clinical examination or laboratory tests associated with burnout. However, the known signs could be grouped according to those indicating acute burnout (lasting for up to one month) and those related to chronic burnout (lasting for many weeks or months).

### Acute Burnout

Acute burnout (or short-term burnout) is the result of an imbalance between exercise and recovery over a period of just a few days or weeks. It occurs when sudden increases in exercise load are introduced to meet emergency needs such as new productions, last-minute changes due to injuries, and so forth. However, the effects of acute burnout quickly disappear when its causes are no longer present. Muscle damage is perhaps the most common outcome indicating that the work volumes exceeded the capabilities of the muscle in question. The most common signs include[2,13,14]:

- Increased normal resting heart rates by 5 to 10 beats per minute;
- Increased resting blood pressure;
- Raised resting lactic acid concentrations;
- Decreased maximal lactic acid levels following intensive physical exercise;
- Following specific dance routines, heart rate return to resting levels may take 2 to 3 times longer than normal;
- Decreased ability of the body to use oxygen during maximal exercise; and
- Muscle damage.

### Chronic Burnout

Chronic burnout (or long-term burnout or overtraining syndrome) is the result of imbalances between exercise and recovery over a period of weeks or months. When the condition is fully developed, the following signs may appear in addition to those mentioned above[15-17]:

- Menstrual irregularities, even cessation of menstruation;
- Susceptibility to infections, espe-

cially of the skin and upper respiratory tract;
- Increased rates of allergies and minor scratches may heal slowly; and
- Loss of maximal voluntary muscle strength.

The first sign suggests a hypothalamic-pituitary dysfunction. Recent reports indicate that low energy availability rather than inadequate body fatness or exercise stress is likely the mechanism by which exercise impinges negatively on the hypothalamic-pituitary-ovarian complex in physically active females.[18] However, low energy reserves are often linked to reduced body-fat stores frequently seen in such active women.[19] The second and third signs clearly indicate a lowering of the body's resistance to infection (i.e., immune system malfunction). As it will be discussed below, the fourth sign seems to be more related to impairment of central rather than peripheral mechanisms.

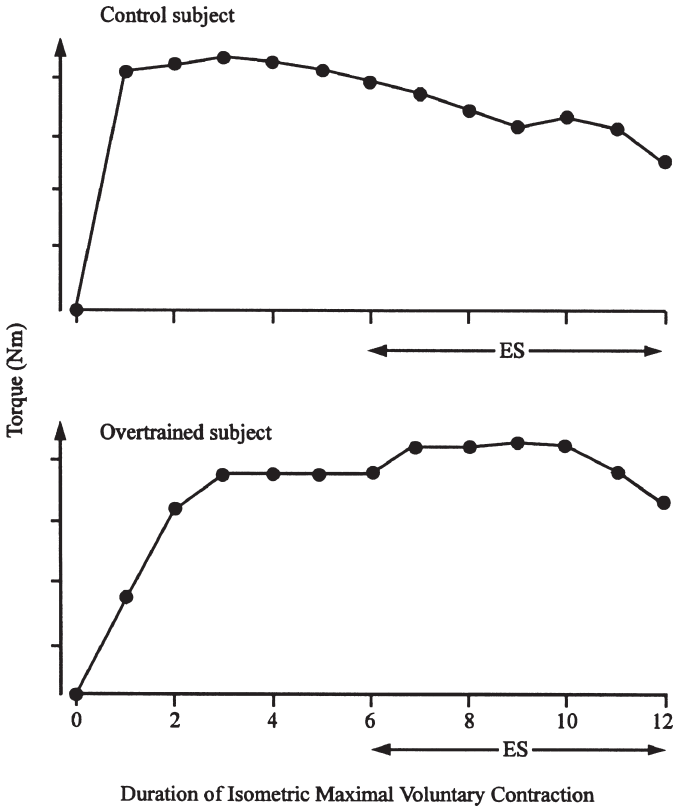


**Figure 2** The effect of electrical stimulation (ES) superimposed on an isometric maximal voluntary contraction of the quadriceps muscle from a healthy control (top) and an overtrained (bottom) subject. (Reproduced with permission from: Koutedakis Y, Frischknecht R, Vrobova G, et al: Maximal voluntary quadriceps strength patterns in Olympic overtrained athletes. Med Sci Sports Exerc 27(4):566-572, 1995.)

## Burnout and the Immune System

It is known that moderate exercise with optimal recovery intervals causes either no changes or enhances the functions of the immune system. However, exhausting exercise tends to produce adverse changes in these functions, including lowered resistance to acute infections, HIV infections, and even cancer.[20,21]

The first scientific papers showing relationships between intense exercise training and the susceptibility to illness appeared early last century. In 1918, Cowles[22] noted that simple respiratory infections could escalate to pneumonia after physical effort that resulted in increased muscular fatigue. The recent expansion of exercise science reconfirmed this negative relationship between high volumes of exercise and immune function. It has been found, for instance, that ultramarathon runners may exhibit increased symptoms of upper respiratory infections.[23] Also, athletes who run more than 100 km a week are twice as likely to exhibit infectious illness than individuals who average less than 32 km per week.[24] No similar information is yet available for dancers.

There is no universal agreement as to what might be the actual mechanism that links increased physical exercise and the reported incidence of infections in athletes. However, Parry-Billings and colleagues[16] provided evidence in support of the hypothesis that the susceptibility to infections following periods of intensive exercise training may be due to lower plasma glutamine levels.

Glutamine is a non-essential amino acid produced in the muscle. This amino acid is necessary for the biosynthesis of the rapidly dividing cells of the immune system and for the provision of a substantial part of the energy required by this system.[25] The lowered plasma glutamine which has been observed following prolonged physical efforts, may be associated with a lower endogenous capacity to synthesize glutamine due to a disproportionate reduction of recovery periods. However, commercially available glutamine supplements may be a short-term solution; recent research seems to have established links between the supplement and lower infection rates following prolonged exercise.[26,27]

## Burnout and Loss of Muscle Strength

In individuals suffering from chronic burnout, loss of maximal voluntary muscle strength is among the confirming signs. Thus, the reduced physical performance reported for such individuals – including dancers – might be the result of a loss of the ability to voluntarily produce high values of muscle strength. However, muscle strength can be often affected at a time when actual muscle function is not impaired, as evidenced by a normal ability to respond to external electrical stimulation. This has led

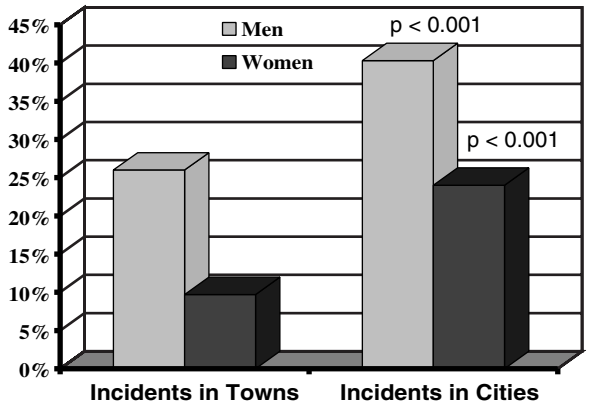


**Figure 3** Overtraining incidents in male and female elite endurance athletes training in either large cities or small towns and rural environments. [Graph compiled from data appearing in: Koutedakis Y, Pashalis V, Sharp NCC: The metabolic basis of athletic events and air-pollution in relation to overtraining. Int J Sports Med (in press), 2000.]

to the development of the "central-fatigue" hypothesis whereby peripheral events are unlikely to account for the low outputs during voluntary muscular exercise in overtrained individuals. Koutedakis and colleagues[15] tested this hypothesis and found that, in overtrained subjects, added electrical stimulation increased the quadriceps torque, thus revealing an inability to voluntary activate all their muscle fibers (Fig. 2). It was concluded that an impaired central (i.e., central nervous system) rather than peripheral (i.e., muscle) mechanisms is the reason for muscular weakness in overtrained individuals. This is in line with data obtained from chronic fatigue syndrome sufferers.[28]

## Burnout and Air Pollution

Although the effects of air pollution on health are well documented,[29,30] little information exists concerning its effect on dance or sport. This is despite some evidence linking air pollution with poor athletic performance during both training and competition.[31,32] Furthermore, it is not entirely clear whether exposure to polluted air, frequently found in cities, is related to more burnout incidents than exposure to less polluted atmosphere, as generally found in smaller towns and rural areas.

A recent study attempted to address this issue using sportsmen and women who were diagnosed as having burnout.[33] It was found that significantly more of these men and women were living and training in cities, with known poor air quality, than in towns or rural areas (Fig. 3). These findings may have a particular significance for dancers, especially elite level dancers who train and perform in urban areas.

## Seasonal Variations in Burnout

Unfortunately there is little information in the dance medicine and science literature concerning the impact that dance training and performance, and specifically the professional dance season, has on the pattern of occurrence of burnout. Yet, knowledge of such variation would be very useful in an attempt to prevent or minimize its occurrence.

In sports, many investigators have described the effects of seasons of competition, training, and reduced training on aspects of physical fitness.[34] Seasonal variations also exist in medical conditions which may prevent normal training and competition. For instance, athletes are more likely to develop an injury and/or become overtrained during their pre-competition and competition cycles and neither the type of physical activity nor the sex of participants interfered with these patterns.[11]

The fact that dancers too are likely to reach the burnout stage at the end of a professional season is supported by a recently published report on female ballet dancers.[9] It was found that most dance-related fitness parameters, such as flexibility and leg power, were lower at the end of a professional season compared to data obtained after 3 to 5 weeks of rest. It was concluded that fatigue, and perhaps burnout prior to rest period, prevented dancers from showing their true fitness potential. A reduction in the ability to reach fitness potentials not only affects dance performances, but also brings dancers closer to a potential injury.[35]

## Burnout and Children

No direct data on burnout and children have been published yet. However, there is enough anecdotal evidence supporting the notion that both health and physical performance may be affected if excessive exercise training is employed during the tender pre-adolescent years. This was also observed by Aristotle (Politics, Book VIII), who wrote that "The disadvantages of excessive training in early years are amply proved by the list of Olympic victors; only two or three of them won a prize both as boys and as men. The discipline to which they were subjected in childhood undermined their powers of endurance."

Given the aesthetic nature of elite dance with its stereotype of the ideal shape, it is not surprising that young dancers, particularly females, tend to be of average height but well below average weight.[36] This emphasis on leanness, especially when accompanied by intensive physical efforts, may contribute to known medical complications in young dancers.[37,38] Therefore, particular attention should be paid to control volumes of physical work during the period of adolescence when the pace of change within the human body is at its most rapid and the consequences of growth and maturation for dance at their most acute.

## Management of Burnout

The concept of "no pain no gain" should be played down by dancers, as there is normally little gain to be made

by working through fatigue, illness, or injury. Although extremely rare, working through viral infections may sometimes cause serious problems that include damage to the myocardium.[39] Research has clearly demonstrated that periods of physical rest (or periods of reduced activity) may result in a drop in the incidence of infectious illness, and may, therefore, contribute to physical performance improvements in active, but tired individuals. This "recovery" period should be at least 3 to 5 weeks long.[40]

Apart from rest, other regeneration techniques may also be used. These techniques include reduction in all stresses through counseling and sleep, together with the use of saunas, massage, aroma therapy, and hydrotherapy.

Once a case of burnout has been diagnosed and treated, there is a danger of relapse approximately three months after again resuming full activity.[41] To avoid such relapse, it is advisable that a reduced or "controlled" amount of dance-related stresses (e.g., classes, rehearsals, and other exercise activity) should be maintained for up to 4 months. Dancers should never attempt to suddenly increase physical loads by more than 5% per week.

Adequate diet is another issue in managing burnout. Calorie,[42] vitamin, and iron[43] deficiencies have been identified as precipitating factors. For example, lack of muscle fuel (i.e., glycogen) may lead to rapid fatigue and may predispose the dancer to prolonged fatigue and burnout. Also, some vitamins, especially the antioxidant vitamins C, D and E, may possibly play a role in the function of the immune system.

## Conclusions

Excessive exercise training, in conjunction with various external stresses, and insufficient recovery can lead to a debilitating syndrome in which dance performance and the general health and well being of the dancer can be affected for months. Acute or short-term burnout must be distinguished from chronic or long-term burnout that can lead to more severe and prolonged side effects. Eliminating or minimizing these problems by providing advice and guidelines on exercise loads, recovery times, nutrition or pharmacological intervention and regular monitoring of athletes using an appropriate battery of markers can help prevent the development of burnout in dancers. Since the research on burnout in dancers is currently limited, an exciting project for dance medicine and science would be to define the exercise doses which will cause the condition and to devise fitness programs that will allow maximal performance with minimal risk of overload.

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